CLAIMS

We claim:

1. A wavelength selective optical switch comprising:

a polarization transformation device receiving input light having a plurality of wavelength components and outputting light of a predefined polarization;

a beam expanding device for expanding said light of predefined polarization in a predetermined plane;

a first dispersive element receiving said expanded light of predefined polarization, and dispersing wavelength components of said expanded light of predefined polarization in said predetermined plane;

a polarization conversion element receiving said dispersed wavelength components of said expanded light of predefined polarization, said polarization conversion element being pixelated generally along the direction of said dispersion such that separate pixels are associated with separate wavelength components of said expanded light, and at least one pixel of said polarization conversion element being operative to convert the polarization of light passing through said pixel according to a control signal applied to said pixel;

a second dispersive element receiving light from said polarization conversion element, and operative to combine said separate wavelength components of said light into multi-wavelength output light;

a beam compressing device aligned such that said multi-wavelength output light is compressed in said predetermined plane; and

a polarization selective device receiving said compressed multi-wavelength output light, and aligned such that only those components of said multi-wavelength output light having a predetermined polarization are transmitted therethrough.

2. A wavelength selective optical switch according to claim 1 and wherein said predetermined polarization has a symmetric polarization to that of said predefined polarization.

3. A wavelength selective optical switch according to claim 1 and wherein said predetermined polarization has an anti-symmetric polarization to that of said predefined polarization.

4. A wavelength selective optical switch according to any of claims 1 to 3 and wherein said predefined polarization is a generally circular polarization.

5. A wavelength selective optical switch according to any of claims 1 to 3 and wherein said predefined polarization is a generally linear polarization.

6. A wavelength selective optical switch according to any of claims 1 to 5 and also comprising at least one of a first focussing element to focus said dispersed wavelength components of said expanded light of predefined polarization onto said polarization conversion element, and a second focussing element to collect said dispersed wavelength components of said light after passage through said polarization conversion element.

7. A wavelength selective optical switch according to any of claims 1 to 6 and wherein said first dispersive element is operative to focus said dispersed wavelength components of said expanded light of predefined polarization onto said polarization conversion element.

8. A wavelength selective optical switch according to any of claims 1 to 6 and wherein said second dispersive element is operative to collect said dispersed wavelength components of said light after passage through said polarization conversion element.

9. A wavelength selective optical switch according to any of claims 5 to 8 and wherein said predetermined plane is generally parallel to the direction of generally linear polarization of said light

10. A wavelength selective optical switch according to any of claims 5 to 8, and wherein said predetermined plane is generally perpendicular to the direction of generally linear polarization of said light.

11. A wavelength selective optical switch according to any of claims 5 to 10 and wherein said control signal applied to said pixel is such as to rotate the direction of the polarization of light passing through said pixel through essentially 90°.

12. A wavelength selective optical switch according to any of claims 5 to 10 and wherein said polarization transformation device is a birefringent crystal having a half wave plate over part of its output.

13. A wavelength selective optical switch according to any of claims 5 to 10 and wherein said polarization transformation device is such that said polarization direction of said at least one output beam of generally linearly polarized light is independent of the polarization of said input optical beam.

14. A wavelength selective optical switch according to any of claims 1 to 10 and wherein said birefringent crystal having a half wave plate over part of its output is a C-polarizer.

15. A wavelength selective optical switch according to any of claims 12 to 14 and also comprising a linear polarizer at the output of said birefringent crystal having a half wave plate over part of its output.

16. A wavelength selective optical switch according to any of the previous claims and wherein at least one of said beam expanding device and said beam compressing device is a pair of anamorphic prisms.

17. A wavelength selective optical switch according to any of the previous claims and wherein at least one of said beam expanding device and said beam compressing device is a single prism.

18. A wavelength selective optical switch according to any of the previous claims and wherein at least one of said beam expanding device and said beam compressing device comprises a cylindrical lens.

19. A wavelength selective optical switch according to any of the previous claims and also comprising at least one of a first linear polarizing element disposed in the optical path before said polarization conversion element, and a second linear polarizing element disposed in the optical path after said polarization conversion element.

20. A wavelength selective optical switch according to any of the previous claims and wherein said polarization conversion element is a liquid crystal cell.

21. A wavelength selective switch module comprising a plurality of wavelength selective switches according to any of the previous claims, and wherein at least two of said wavelength dependent switches utilize a common one of at least one of a dispersive element, a focusing element and a polarization rotating element.

22. A wavelength selective optical switch comprising:

a polarization transformation device receiving input light having a plurality of wavelength components and outputting light of a predefined polarization;

a beam expanding device for expanding said light of predefined polarization in a predetermined plane;

a dispersive element receiving said expanded light of predefined polarization, and dispersing wavelength components of said expanded light of predefined polarization in said predetermined plane;

a polarization conversion element receiving said dispersed wavelength components of said expanded light of predefined polarization, said polarization conversion element being pixelated generally along the direction of said dispersion such that separate pixels are associated with separate wavelength components of said expanded light, and at least one pixel of said polarization conversion element being operative to convert the polarization of light passing through said pixel according to a control signal applied to said pixel; and

a reflective surface disposed in proximity to said polarization conversion element and on the distal side of said polarization conversion element relative to that on which said light passing through said pixel is incident, such that said light is reflected back through said pixel of said polarization conversion element.

23. A wavelength selective optical switch according to claim 22 and wherein said predefined polarization is a generally circular polarization.

24. A wavelength selective optical switch according to claim 22 and wherein said predefined polarization is a generally linear polarization.

25. A wavelength selective optical switch according to claim 24 and wherein said control signal applied to said pixel is such that the polarization of said light

of said wavelength component is rotated through essentially 90° after returning through said pixel.

26. A wavelength selective optical switch according to any of claims 22 to 25 and wherein said light returning through said pixel is directed back through said polarization transformation device for outputting from said switch.

27. A wavelength selective optical switch according to any of claims 22 to 26 and wherein said input optical beam is obtained from an input fiber, and said light returning through said pixel for outputting from said switch is directed into an output fiber, and wherein said switch also comprises a circulator to separate light in said output fiber from light in said input fiber.

28. A wavelength selective optical switch according to claim 24 and also comprising a linear polarizer having an extinction ratio disposed between said polarization conversion element and said reflective surface, said linear polarizer having its direction of polarization essentially parallel to that of said light of generally linear polarization, and wherein said control signal applied to said pixel is such as to rotate the direction of the polarization of light of said wavelength component passing through said pixel through essentially 90°, such that said light of said wavelength component transmitted onwards through said linear polarizer is generally attenuated by said extinction ratio.

29. A wavelength selective optical switch according to claim 28 and wherein light of said wavelength component reflected from said reflective surface is attenuated generally by said extinction ratio also in returning through said linear polarizer, such that the attenuation of said light of said wavelength component is generally proportional to the square of the extinction ratio of said linear polarizer.

30. A wavelength selective optical switch comprising:

a dual fiber collimator inputting a fiber optical signal having a plurality of wavelength components, and outputting light having a plurality of wavelength components;

a first polarization transformation device receiving said light output from said dual fiber collimator, and outputting light of a predefined polarization;

a beam expanding device for expanding said light of predefined polarization in a predetermined plane;

a dispersive element receiving said expanded light of predefined polarization, and dispersing wavelength components of said expanded light of predefined polarization in said predetermined plane;

a polarization conversion element receiving said dispersed wavelength components of said expanded light of predefined polarization, said polarization conversion element being pixelated generally along the direction of said dispersion such that separate pixels are associated with separate wavelength components of said expanded light, and at least one pixel of said polarization conversion element being operative to convert the polarization of light passing through said pixel according to a control signal applied to said pixel;

at least two reflective surfaces disposed relative to said polarization conversion element, such that said wavelength components of said light of generally linear polarization are directed back through said beam expansion device and said dispersive element, said dispersive element combining said separate wavelength components of said output light into multi-wavelength output light; and

a second polarization transformation device aligned such that that part of said multi- wavelength output light having said predetermined polarization is transmitted therethrough and is output from said switch through said dual beam collimator.

31. A wavelength selective optical switch according to claim 30 and wherein said predefined polarization is a generally circular polarization.

32. A wavelength selective optical switch according to claim 30 and wherein said predefined polarization is a generally linear polarization.

33. A wavelength selective optical switch according to claim 32 and wherein said control signal applied to said pixel is such as to rotate the direction of the polarization of light passing through said pixel through essentially 90°.

34. A wavelength selective optical switch according to any of claims 30 to 33, and also comprising a beam deviating element operative to receive an optical beam output from said dual fiber collimator, and to direct said beam into said first polarization transformation device, and to receive said output light from said second polarization transformation device, and to direct it into said dual fiber collimator.